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ABSTRACT

An Australian university architect studying management information systems programs at academic institutions in the United States visited 26 universities and colleges and nine educational and professional associations, including extended visits at the University of Wisconsin and the National Center of Higher Education Management Systems. During these visits, he investigated university and college space utilization programs, gained operational and developmental experience at institutions with education philosophies similar to those in Australia, and examined trends in low cost student housing. This report of his observations focuses on management information systems projects throughout the academic community, resource accountability, energy conservation, facilities planning for the handicapped, student housing, and interdisciplinary approaches to education. (RAA)

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MANAGEMENT INFORMATION SYSTEMS

KELVIN CRUMP

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STATEMENT OF PURPOSE

The primary purpose of my travel grant from the Australian - American Educational Foundation (AAEF) was to allow me to work with Management Information Systems developed in and for tertiary educational institutions in the United States with particular emphasis on Space Utilisation Programs. I particularly sought to apply this experience at selected universities which had implemented Management Information Procedures.

Griffith University has adopted a Schools Educational and Organisational System, where a School is defined by a set of external problems suited for independent enquiry. Our Schools are the primary basis for the teaching, research, and community services activities of the University and are the basic administrative elements of academic activities. It was intended that each of our Schools have a separate physical identity to support this educational philosophy and allow the maximum opportunity for the inter-disciplinary functions of each School to operate.

The inter-disciplinary structure for Schools imposes more complex demands on space usage than is the case in the "traditional university." This complexity is highlighted in the disposition of research, teaching and office spaces, where the planning intent is to encourage a beneficial inter-disciplinary mix without wasteful increases in gross areas or costs.

The second purpose of my AAEF travel grant was to allow me to gain operational experience at tertiary educational institutions exploring educational philosophies similar to our own, particularly with regard to their development phases and current operations.

A third area of investigation was to look at trends in student housing, particularly low-cost student housing.

I felt that information gained as a result of this grant could be immediately applicable to the growth of our new University which accepted its first students in 1975 and could lead to improvements in our briefing, co-ordination, and planning techniques as well as possible savings in time and money.

MANAGEMENT INFORMATION SYSTEMS

Of the institutions and organisations visited the most significant contributor to the development of Management Information Systems was the National Centre for Higher Education Management Systems at WICHE (Western Interstate Commission for Higher Education) at Boulder, Colorado.

NCHEMS was established in 1968 and is the primary component of the Planning and Management Division of WICHE. Its mission was to improve planning and management in post-secondary education through:

1. Better information to support decision-making.

2. Enhancing communication of planning and management information within institutions, and between the institutional, state and national levels in post-secondary education.

3. Better analytical tools and procedures to support decision-making and policy formulation.

4. Strengthening capability within the post-secondary education community to deal with planning and management problems.

The role of NCHEMS was to act as a focus for the collective voluntary effort of institutions and agencies that wish to improve planning and management in post-secondary education. At the time of my visit the participants advisory assembly had some 600 institutions represented.

NCHEMS also seeks to:

1. Act as a spokesman for the planning and management needs and interests of its constituency.

2. Provide a reference point for gauging the state of the art in planning and management systems.

3. Create the standard planning and management communication base used in post-secondary education.

NCHEMS operates on the premise that post-secondary education can be improved through: a) better information; and b) more effective use of this information in decision-making. The effort is concentrated on two major programmatic thrusts: a) the NCHEMS communication base; and b) the NCHEMS analytical procedures program. NCHEMS also periodically undertakes studies to gauge the impact of its systems in the post-secondary area.

NCHEMS developed a nationally adopted FACILITIES ITINERARY AND CLASSIFICATION MANUAL which was first produced by them in 1972 and which has been subsequently reviewed and amended with the Department of Health Education and Welfare, Office of Education. This manual established an inventory system in the institutions of higher education in all 50 states and lent itself to the generation of the first reliable national and comparable state totals, of the quantitites of physical facilities of various types. The current edition (1973) has been reviewed in light of a number of events which include:

1. Publication of the TAXONOMY OF INSTITUTIONAL PROGRAMS IN HIGHER EDUCATION by the National Center for Educational Statistics (NCES) of the US Office of Education and incorporation of the Taxonomy into the Higher Education General Information Survey (HEGIS).

2. Development of the Program Classification Structure (PCS) 1972 by NCHEMS to provide a better tool for clarifying management concepts of higher education. The major institutional programs of the PCS are: Instruction, Research, Public Service, Academic Support, Student Service Institutional Support, Independent Operations and

Student Access. PCS elements are being incorporated with other NCHEMS products that deal with students and also will be incorporated in other NCHEMS products. PCS use as a common structure is particularly important since it enhances the opportunity to establish the relationships between activities and resources.

In co-operation with the American Association of Collegiate Registrars and Admissions Officers, NCHEMS have developed a set of manuals called the HIGHER EDUCATION FACILITIES PLANNING AND MANAGEMENT MANUALS which have been widely implemented. The manuals discuss the facilities planning cycle, describe techniques for evaluating the capacities and projecting the requirements for classroom and class laboratory facilities, suggest similar procedures for office and research facilities, analyse procedures for determining needs for academic support facilities, and discuss other major types of general support facilities. A further section contains a description of the detailed program planning and analysis procedures which yield the inputs for facilities planning process.

NCHEMS have also been instrumental in the production of a DATA ELEMENT DICTIONARY. A second edition of this dictionary has been prepared under the guidance of the Data Element Dictionary Task Force. The DATA ELEMENT DICTIONARY aims to act as a guide in identifying those data that should be available to aid developmental tasks at post-secondary institutions. The DATA ELEMENT DICTIONARY identifies and describes:

1. Those data elements required to support current NCHEMS products.

2. Certain data elements anticipated as being required for future NCHEMS products.

3. Certain data elements commonly maintained by institutions for operational and reporting purposes.

4. Certain terms that are needed to help identify institutional characteristics for exchange purposes that are not generally in an institutional data file.

By the introduction of these manuals NCHEMS have made significant steps toward establishing the procedures for a standard planning and management communication base in post-secondary education. The only adverse comments I encountered when querying the application of these manuals were concerned with the time and cost in either assembling information in the first instance or translating from an already existing system.

Of the NCHEMS products two areas of particular interest to me were concerned with Resource Requirement Prediction Modelling (RRPM.1.6) and Information Exchange Procedures (IEP).

RRPM.

The Technical Report 104 published by NCHEMS describes the RRPM1.6 as follows:

"The Resource Requirement Prediction Model (RRPM1.6) is an instructional cost simulation model developed for use in all types of post-

secondary institutions. This RRPM is used to enlarge various alternatives for the utilisation of a limited set of resources. It was also seen as providing a useful point of departure for those institutions wishing to adapt a cost simulation model to their own specific needs. RRPM is designed to estimate instructional resources and their related costs. It is a generalised software package designed to run on a medium-sized computer and most mini-computers and because it is generalised every campus receives the same basic set of computer software and "tailors" the model to reflect organisational characteristics through input data. Earlier versions of RRPM were more detailed and comprehensive. NCHEMS have simplified this version (RRPM1.6) to reduce data-collection and to facilitate understanding of the model's computations and assumptions."

I queried a number of institutions on this point and established that the main reason they had for adopting RRPM1.6 was that it was the simplest of the Prediction Models currently available and did not require elaborate preparation of data. An area of Prediction Modelling which I felt could be expanded was that concerned with Physical Facilities. To have information simultaneously available for physical space requirements, capital costs, and even recurrent costs would be a most useful planning aid.

IEP.

The purpose of the NCHEM Information Exchange Procedures project is to create the capability for exchange and reporting of that information, both financial and otherwise necessary to calculate and evaluate costs. The calculations and evaluations would be carried out by discipline and course level, student major and student level, and per unit of input.

An initial objective was to establish a methodology for developing and exchanging information on education costs.

NCHEMS identified a number of broad principles for the development of a system for exchanging and reporting comparable information. First, the collected data should be useful to the decision-making and planning process of post-secondary education. Second, the conventions and procedures for aggregating the collected data must be uniform and acceptable. Third, information for exchange and reporting should arise from uniform, acceptably defined terms. Finally, one of the fundamental considerations for such a system is that reporting and exchange constitute two-way thoroughfares, and that appropriate feedback mechanisms for both generators and suppliers of the data be indispensable.

Again, the only adverse comments I encountered from institutions which had either carried out initial work with IEP or who had considered its adoption were concerned with the time and money costs associated with compiling data. A consideration, expressed by NCHEMS about IEP and certainly commented on at a number of the institutions I visited, was to do with possible misuse of IEP information. They acknowledge that opponents of IEP suspect that data could be used against the institution or could be misapplied or unfairly used, and that it could encourage outside intervention in the operations of the institution.

ACCOUNTABILITY

Accountability in post-secondary education seems to have been a generator of many of the systems, procedures and models developed in the United States in the late 1960s and early 1970s, when federal agencies, state agencies, governing boards, private donors, and the public at large were requesting that the resources they provide be used efficiently and effectively. Most institutions I visited had implemented some form of Management Information System, including sophisticated "in house" systems, systems instituted at state level and NCHEMS systems.

The same trends can be observed in the Australian post-secondary education areas and in a situation where almost all allocation of resources is controlled centrally through a federal agency, and where the quantity of resources available is reducing, we should anticipate a central requirement for Management Information and contribute to the systems to be implemented.

Over recent years there has been a rapid development in techniques for the planning, allocation, and operation of physical facilities that are large and complex. A major reason for this is the enormously increased value of these physical resources, resulting primarily from the skyrocketing construction cost of replacing them and the rapidly accelerating cost of operating them.

As a direct result of these new techniques it is now possible to better utilise existing facilities and proposed facilities and at the same time lower the cost of operating them. In addition to the valuable work at NCHEMS I was able to visit a number of organisations and institutions which were also making major contributions to the developments of Management Information Systems.

At Massachusetts Institute of Technology a computerised space accounting system for storing, manipulating, and retrieving vast quantities of factual data concerning building space and physical facilities has been developed. The system is called INSITE II - Institutional Space Inventory Techniques-and was developed in the early 1970s as an "in house" tool. Other organisations became interested in the system and at the time of my visit there were 24 external uses of INSITE II which included other universities, hospitals, banks and industry.

On a state-wide basis in 1973 the University of Wisconsin system, consisting of 13 campuses, introduced a central data request system to replace individual data systems operated by the various universities. A significant benefit resulting from this centralised system was the establishment of a common language for state-wide analytical planning and management purposes. The system was operating smoothly and is up-dated and amended from time to time. One criticism of this centralised system was that it was completely separated from the individual campuses who therefore had no terminal access to the central computer and could only obtain information by specific request.

Educational Resources Information Centre.

The ERIC (Educational Resources Information Centre) clearinghouse on higher education is a nation-wide comprehensive system, consisting of 16 clearing-houses designed to identify and disseminate information in all areas of education. The range of information covered is extensive and is made available nationally and internationally through their microfiche service covering some 650 institutional libraries. ERIC also arranges for the commissioning and publication of research reports. During 1977 Ben Lawrence, executive director of NCHEMS, and Allan L. Service of NCHEMS produced a research report, "Quantitive Approach to Higher Education Management", for ERIC. The research report is an assessment of the current state of knowledge about quantitive approaches to higher education and examines the factors which have encouraged initiations to consider the quantitive approach. In the late 1960s and early 1970s competing priorities for available resources, demographic forecast of sharply declining enrolments among traditional college-age populations, and public debate about the benefits of higher education have brought about increased awareness that higher education institutions require effective management. Scepticism about employing quantitive management techniques to increase the essentially qualitative process of higher education resulted in external pressures for better accountability methods. This prompted higher educational institutions to try a variety of quantitive management approaches that draw on fields such as economics, mathematics, statistics, engineering, information service, and psychometrics.

Association of Physical Plant Operators.

The APPA (Association of Physical Plant Operators of Universities and Colleges) is a long-established association with membership covering many American institutions as well as international institutions. The APPA has been long involved in the research, development, and publication of material concerned with facilities management. Energy management, conservation, and procedures have been a focus for APPA and, together with the American Council on Education (ACE) and the National Association of College and University Business Offices (NACUBO), the association formed an Energy Task Force which in 1977 published ENERGY MANAGEMENT FOR COLLEGES AND UNIVERSITIES. Our own institutions in Australia will benefit greatly from access to this valuable information.

Educational Facilities Laboratories.

In New York the EFL (Educational Facilities Laboratories) was a most useful reference source. A recent publication, entitled SPACE COSTING - WHO SHOULD PAY FOR THE USE OF COLLEGE SPACE by Sy Zachar, examines alternatives to the traditional methods for servicing and maintaining institutional space. The costs of owning and operating physical facilities are devouring an ever-increasing share of the budgets of colleges and universities. In the past, academic and operating units of colleges have viewed their space as a free commodity and have often used it extravagantly. If these units included the cost of space in their budgets perhaps they would use space more efficiently and operate it more prudently. In particular, Sy Zachar looks at the pros and cons of this concept of facilities management - space costing.

Colorado State University - Fort Collins.

The Colorado State University at Fort Collins was one of the very early users of NCHEMS products, as well as implementing a progressive program of its own for the assembly and use of data. Strong emphasis is placed on the efficiency and practicability of its systems. Operationally there is a central program group whose overall responsibility is to co-ordinate the assembly of information and to ensure compatability of information between the various users.

In 1971 the University embarked on a program involving management tools in the area of computer-simulation and modelling. In addition to expanding the basic information available to management, the newer efforts were designed to support long-range planning activities. During 1972 the University had operational the NCHEMS, Induced Course Load Matrix (ICLM) system and the RRPM1:6 implemented during 1973.

The ICLM indicates the instructional loads placed on academic departments by various student majors. This information is useful in its own right and a necessary foundation to cost simulation modelling. Two kinds of ICLM information are distributed to department chairmen, deans, and central administrators quarterly, giving these administrators a basis for determining inter-relationships between departmental work performed and taken by departmental majors. The first set shows what each department is producing from each major; the second shows where the majors are taking their work.

The RRPM is a valuable tool for producing planning and cost data. The model is used to predict faulty needs for internal budgeting requirements and to assess teaching productivity in terms of student credit hours generated per FTE (Full Time Equivalent) faculty. The model has also been used to satisfy external requirements such as budget request documents and for resource planning.

Gallaudet College.

At Gallaudet College, in Washington, D.C., the major activities of the college were co-ordinated by CTM (Critical Test Management) network and included administrative and academic planning in its activities. The system, which was developed by R Orin Cornett, Vice-President for Planning and Public Service, Gallaudet College, was to co-ordinate the ten-year master plan development program and has been operating successfully since 1973. My interest was the planning by "objectives" approach to the master plan which included the establishment of measurable program and institutional objectives by all institutional departments and of measurable program and performance objectives by non-instructional departments. The major long-range planning operation was designed to produce the following:

1. By July 1, 1973, a revised ten-year program plan covering all aspects of the college and embodying these:

   A revised updated statement of the mission of the college expressed in terms of measurable objectives and indicating priorities for the periods 1973 to 1978, and 1978 to 1983.

A projection of the college's enrolment for the next 15 years, taking into account the national need for post-secondary education for the deaf and the estimated contribution of other post-secondary institutions likely to meet part of that need.

Measurable program objectives for all departments and units.

Measurable instructional (student performance) objectives for all instructional departments.

PLANTRAN-II computer simulation models for each of the major units of the college, making possible the convenient projected budget and program parameters on the basis of wide variety of assumptions.

A computer-based inventory of all assignable classroom laboratory, office and other space, programmed for evaluation of space functions, availability of use and for continued updating.

An affirmative action plan for the college, aimed at equitable employment, advancement, and remuneration without regard to sex or race.

Plans for a program of evaluation of overall institutional effectiveness.

A built-in program for continued updating of the master plan.

2. By July 1, 1973, a preliminary draft of facilities requirements for the program described in the master plan.

3. By January 1, 1974, an updated comprehensive physical plant master plan for the college, including conceptual studies of feature buildings and planned major modifications to existing buildings required by the program master plan.

City University of New York.

During late 1977 and early 1978 CUNY, through its Long Range Planning Committee, completed a major exercise aimed at assembling data to assist in the management of its 19 campuses. It was planned to develop more effective processes for future decision-making, based on this information. The use of Management Information Systems was seen as a tool to assist in bidding for scarce New York City funds and provide information concerning matters of accountability in the University system.

State University of New York System.

In visits to the Stonybrook and Amherst campuses, I was able to discuss the extent to which the universities could operate independently and the level of information required for the central system. Management Information Systems were efficient, although the extent of central system involvement in local decision-making was significantly greater than in the Australian system.

University of California System.

In the University of California system I visited individual campuses and the statewide administration. At the time of my visit recommendations from a report, "An Evaluation of Physical Planning and Construction Activities for the University of California" by Booz, Allen, and Hamilton, were in the process of being implemented. The main force of these recommendations was to provide improved direction for the University's capital outlay process in a time of limited resources, and to strengthen the role of campuses in performing the operational task of university administration.

Limited resources had forced institutions to re-examine areas of historically accepted costs. The concept of Zero Base Budgeting was being examined by a number of institutions, particularly UCLA. This strengthening of the role of the individual campus emphasised a difference between American and Australian universities. In the areas of planning and construction the individual campuses in Australia conduct their business with a greater autonomy than I experienced in America and it was interesting to see recommendations being implemented which aimed to provide greater autonomy for individual campuses.

Other organisations making significant contributions in the field of Management Information Systems are NACUBO (National Association of College & University Business Offices), CASE (Council for Advancement & Support of Education), ACE (American Council on Education), and SCUP (Society for College and University Planning). The publications, newsletters, surveys, libraries, conferences, and information services of these organisations make "keeping in touch" with current practices and new directions much simpler than is currently the case in Australia.

ENERGY CONSERVATION

An area in which a great deal of productive work was proceeding was energy conservation, and I believe that a great deal of the information being produced and techniques evolved are particularly relevant to Australia. Energy conservation programs and management information systems are closely linked and, at times, it was obvious that the need to conserve energy had caused particular institutions to introduce systems that they may not otherwise have in the same time framework.

The major catalyst in this development was the Energy Crisis of 1973-1974. First were predictions that, during 1973 in the United States, energy demand would for the first time exceed supply. Subsequently came the squeezing shut of the Arab oil supply. Towards the end of 1973 the cost of a barrel of oil nearly doubled.

The rapid depletion of traditional non-renewable sources of fuel and the sudden rise in energy costs has posed severe problems for

institutions of higher education. Spiralling expenditures for oil, gas, and electricity have been a major economic drain for these non-profit organisations. The energy crisis, therefore, has a direct bearing on academic planning and the quality of education. Further, there were peculiar conditions which distinguished colleges and universities from other energy users and which pose special problems and challenges for conservation:

1. The variety of buildings of various ages employing a multitude of materials and energy-dependent systems, serving a vast range of purposes.

2. The decentralised authority and responsibility within institutions makes a huge number of users responsible for energy use - its saving or waste.

3. Continuity of authority within institutions poses energy management problems. Deans, chairmen, committee members, and students are regularly changing, making energy education and energy awareness a never-ending problem.

4. Non-discretionary energy use: energy is used for space heating, cooking, essential medical and health care facilities, library lighting, research and other uses essential for academic purposes. These services can only be curtailed at the expense of academic quality or personal comfort. The potential for conservation is often limited by the uncompromising nature of the energy end users.

5. Unlike commercial and industrial energy users, it is difficult for institutions of education to pass increased energy costs onto their customers.

Educational Facilities Laboratories.

The EFL (Educational Facilities Laboratories) provided a report to the United States Energy Research and Development Administration in April 1977, entitled "Energy and Educational Facilities - Costs and Conservation", which examined the possibilities for energy conservation across the whole spectrum of the education system and reported on the implementation of energy conservation procedures. The summary contained in the report highlights the necessity of Management Information Systems with adequate historical data and the adaptability to examine energy conservation possibilities. This summary points out that educational facilities in America consume 1.5 per cent of all the energy use in the nation and 5 per cent of the energy use for heating and cooling buildings. Because education involves one out of four Americans its energy conservation efforts can have a broader impact than is suggested by the consumption figures. It can help set the pattern for a national conservation program. If educational enterprise could reduce consumption 30 per cent below its 1974-1975 academic year level, it would achieve 5 per cent of the nation's 1985 conservation goal established by the FEA (Federal Energy Administration).

Energy conservation programs include facilities management (without capital investment) and have the potential for 20 per cent savings of

current consumption or a cost avoidance of $600 million dollars. Colleges and universities have made some progress in this area but not many school districts have.

The same benefits (20 per cent energy savings and a cost avoidance of $600 million dollars) can be achieved by capital investments with pay off periods of up to five years. Some colleges have made such investments but there is little evidence that school districts are making capital investments.

More substantial capital investments with a pay back period of up to ten years can earn another ten to twenty per cent reduction. The educational sector has not attempted these.

Many constraints have thus far prevented more extensive conservation programs in educational facilities - lack of funds for basic survey, engineering and capital improvements, plant operating personnel, insufficient training and, most of all, the sense that energy conservation is not the highest priority when measured against the other crises facing education today.

Finally, preparation of this report has revealed inadequate basic data or conflicting data concerning education's share of energy consumption. It also revealed that information concerning conservation is fragmented and often unavailable. Because responsibility for education in America is decentralised among 3 000 colleges and universities and 17 000 school districts, it is not surprising that the monitoring of energy consumption and the impact of conservation measures are haphazard and would greatly benefit from a clearing-house activity.

The Federal Energy Administration is in the process of completing an energy audit on nearly all the nation's schools (including primary, secondary, and post-secondary) by providing federal funds for the audit, the average cost of which was estimated to be $340 per 50 000 square feet of building space.

A report by the House Interstate and Foreign Commerce Committee indicated that under FEA's most optimistic projection (which was a proposed $900 million program in schools and hospitals) only about one third would receive federal grants.

In addition to an adequate energy data base, three basic steps have been identified in approaching energy conservation:

1. Quick fix - Energy conservation reduction measures that achieve rapid and significant energy savings at negligible cost or at a cost that can provide a return on investment in no more than six months. These modifications would normally be accomplished by operator and maintenance personnel and usually result in energy reduction of at least 10 per cent.

2. Refit - Energy conservation reduction measures that require modest capital investment but can yield an additional 10 per cent to 15 per cent in energy savings with pay backs in a period of six months to three years.

3. Systems Convert Modifications - Energy consumption reduction measures that are most sophisticated and expensive generally involve major changes in systems designed; this should yield at least an additional 10 per cent savings in energy with pay backs in two to five years.

A joint Energy Task Force comprising ACE, APPA and NACUBO produced in 1957 a most useful and practicable guide to energy conservation procedures entitled ENERGY MANAGEMENT FOR COLLEGES AND UNIVERSITIES.

Yale University.

Yale University is regarded as an innovator and leader in the energy conservation field in post-secondary education. It introduced a "Utilities Conservation Program" in 1970 and the systems developed there prior to the energy crises have benefited other colleges and universities greatly. Yale has also installed a Building Master Operating Control (BMOC), a computerised energy control system which has been progressively expanded since its installation in 1974. The system includes heating and fuel controls, damper, fire and pump monitoring and audio contact with mechanical rooms in laboratory buildings. It will run log time and provide up to the minute feedback on operating efficiency of complex machinery. Nearly half of the 200 buildings at Yale University are connected to BMOC. Essential to the whole program at Yale has been "Energy Education," a means of helping and training the individual through energy awareness promotions, introducing energy related topics, and promoting competitions for energy conservation techniques which could be implemented.

NACUBO.

NACUBO has actively promoted management efficiencies and since 1976, in conjunction with United States Steel, has staged an annual cost reduction incentive award scheme for American institutions. The awards are in recognition of outstanding cost reduction programs, implemented during the previous calendar year with monetary awards ranging from $10 000 to $1 000. In 1977, 18 institutions received awards. The most common areas of cost reduction in the awards were energy conservation measures.

University of Wisconsin - Green Bay.

During my visit to the University of Wisconsin - Green Bay, I had the opportunity to study the energy conservation measures introduced in 1974 by the state of Wisconsin through its State Bureau of Facilities Management, for the Conservation of Energy for State Facilities. These were produced as "Building Design Guidelines for the Conservation of Energy for State Facilities" and formed part of the BUREAU OF FACILITIES MANAGEMENT POLICY AND PROCEDURES MANUAL.

All state facilities, which included the educational institutions, were required to conform to these procedures. These guidelines required submissions on projects to be accompanied by an analysis of the building and its energy systems, covering:

1. The thermal values of materials used.

2. Heating, ventilating and air-conditioning systems.

3. Water conservation.

4. Electrical design.

At the time of my visit, the University of Wisconsin - Green Bay was tendering a computer-controlled building monitoring system (estimated cost $320 000) with specific emphasis on energy control systems. Estimates indicated a payback period of four years.

The energy conservation programs implemented by the state of Wisconsin required the individual institutions to accept responsibility for reduction in energy consumption. The industrial institution was to be accountable for energy conservation results which had been established as goals in a system-wide conservation program. Energy Conservation Program Advisory Groups are recommended for each institution with staff and student representation. Each institution is required to develop goals and objectives which are to clearly establish a commitment to energy conservation. Check lists are extensive and include academic scheduling to obtain the most energy efficient utilisation of teaching space.

SECTION 504 OF THE REHABILITATION ACT

Although not specifically in my study program, I was most interested to observe the impact that Section 504 of the Rehabilitation Act was having in post-secondary institutions. Section 504 of the Rehabilitation Act of 1973, as amended, mandates equal opportunity of qualified handicapped persons in education programs, and activities of all recipients of federal financial assistance. Section 504 was implemented on 28th April, 1977, and is a Civil Rights Statute that prohibits discrimination on the basis of handicaps and obligates colleges and universities to make certain adjustments and accommodations, and offers to handicapped persons the opportunity to participate fully in all education programs and activities. In many cases the regulations called for dramatic changes in the action and attitudes of institutions who are recipients of HEW (Department of Health Education and Welfare) federal funds. Colleges and universities receiving HEW funds must respond to the following requirements of the regulations:

1. All new facilities must be barrier-free.

2. Programs or activities in existing facilities must be made accessible to the handicapped within 60 days and, if necessary, structural changes must be made within 3 years.

3. Qualified handicapped persons may not, on the basis of handicap, be denied admission or employment even if facilities have not been made value free.

4. Colleges and universities must make reasonable modification in academic requirements, where necessary, to ensure full educational opportunity for handicapped students.

5. Educational institutions must provide auxiliary aids such as readers in school libraries, or interpreters for the deaf.

Within the educational institutions this was seen to be as significant as Title VI of the Civil Rights Act of 1974 and Title IX of the Education Amendments of 1972 and their companion regulations, which were critical elements in the structure of law protecting the civil rights of racial minorities and women. The self-evaluation under Section 504 was the principal process through which compliance with the Statute was to be assessed and full participation in programs and activities was to be ensured. Through the self-evaluation, which was to be completed by 3 June, 1978, all policies and practices of a college or university were to be evaluated to determine their effect or potential effect on handicapped persons. As required, policies and practices would be modified to meet standards of non-discrimination on the basis of handicap. The regulations for implementing Section 504 were written by HEW - Office for Civil Rights (OCR).

In the evaluation process and subsequent keeping up to date phase, the task was certainly made easier for those institutions operating adequate Management Information Systems.

Initially only limited federal funds were to be made available for the construction of facilities. The cost of complying could be high, particularly in the large older institutions, and during my tour it was obvious that many institutions felt that more federal and state funds should be made available to assist in complying with Section 504.

INTER-DISCIPLINARY APPROACH TO EDUCATION

University of Wisconsin - Green Bay.

During this section of my program I sought to study university systems that had explored educational philosophies similar to the inter-disciplinary schools approach of my own university. My major research work was at the University of Wisconsin - Green Bay. This University accepted its first students in 1969, six years prior to my own university. Although I found many similarities in the approach to an educational philosophy, the outcomes at times were quite dissimilar.

A comprehensive development plan was produced for the University in 1968, summarising planning action which had been commenced in 1965, for the establishment of a new university on approximately 600 acres of farm land bordering on Green Bay. The site was tested against a requirement for possible growth of 20 000 by the year 2000. Dr Edward W. Weinder has been Chancellor since 1966 and was instrumental in the development of teaching philosophies, the main thrust of which was people in the world in which they live. Broadly, the academic plan was founded on:

1. Commitment to an involvement in the world about which people seek to learn.

2. Concern for society and its constructive improvement.

The University determined to focus on ecology, including the ecological crisis, as its special scholarly activity. The ecological focus was to be inter-disciplinary and broadening and liberal in its educational tone: the study of man in his environment with an approach to knowledge demanding close collaboration between university and the community.

The college system adopted is based on environmental themes. Two colleges were to investigate certain types of environment:

1. College of Environmental Sciences, which emphasises the problem of the natural resources environment.

2. College of Community Services, which focuses on the social environment.

The other two colleges are concerned with the individual within his/her environment:

1. College of Human Biology, centres its attention on human adaptability.

2. College of Creative Communication emphasises the problem of human identity.

The colleges were to be responsible for developing their own courses with team teaching being introduced to handle inter-disciplinary courses. The special character and purpose of the University of Wisconsin - Green Bay can be further delineated by the following statements of its particular goals and responsibilities.

Dr Edward W. Weinder comments as follows on the philosophy of the University:

> "The University should offer a focus institution-wide academic program that is innovative and substantially unique in both its goals and organisation, emphasising inter-disciplinary problem-centred study of man in the environment.
>
> To this end:
>
> 1) The University should develop, test, and evaluate new mission-related educational programs and procedures.
>
> 2) The University should strengthen multi-disciplinary and inter-disciplinary concentrations which support the ongoing academic mission.
>
> 3) The University should develop problem solving approaches to investigating and learning especially in the mission related areas.

4) The University should offer programs leading to professional certification or equivalent in areas clearly associated with its mission.

5) The University should provide basic graduate education which grows clearly and directly from the unique organisation and goals of the undergraduate programs.

6) The University should support inter-changeable ideas and techniques among individuals, the university, and the community to improve the quality of life.

7) The University should develop appropriate inter-institutional program relationships within the region, while serving the State as a uniquely orientated educational resource."

Strong emphasis was placed on contact between the University and community in both formal and informal contacts. Within the University there was to be increased time and opportunity for staff and student interaction.

Physical planning provided for a series of sub-centres, which would not exceed four stories, focusing on a central library facility. Controls were established to co-ordinate the external colours of materials in buildings. Special emphasis was placed on landscaping elements, paving materials and textures, signs, writing, seating, etc., with reinstatement of the native trees and shrubs - a positive commitment. Student housing was to cater for single and married students, with the intention of providing a range of accommodation styles. Development was planned to establish the "university atmosphere" from the first.

The educational and physical development philosophies of the University of Wisconsin - Green Bay and Griffith University are remarkably similar, with many of the statements previously listed concerning the University of Wisconsin - Green Bay being common to Griffith University.

In a development sense, the University of Wisconsin - Green Bay had planned in terms of 20 000 by the year 2000. Griffith University was planned for 10 000 by the 1990s. For the year 1978 the University of Wisconsin - Green Bay has 3 700 students and Griffith University 1 400. Problems common to educational institutions in the United States and Australia were severe cutbacks in funding, and a sharp drop in the number of students enrolling.

At the University of Wisconsin - Green Bay student numbers were about static with only a slow growth in student numbers to a long-term figure of 10 000. Griffith University now sees a growth situation which anticipates about half the previous student numbers predicted (5 000) by the 1990s. I do feel that this lack of momentum at both universities has had a noticeable effect on staff and student morale. Expectations have been diminished, and relatively minor matters seem to become major internal issues involving real conflict between philosophy and current reality. It could also be that this newness and smallness does not provide the diverse possibilities that a larger and self-generating institution does.

The most observable differences between the two institutions related to physical interpretations of philosophy. At Griffith University it was intended that each of the Schools have a separate physical identity to allow the fullest opportunity for the inter-disciplinary functions of each School to operate and provide an identifiable home for the students of each School. This, to a major degree, has been achieved and was only curtailed by funding cutbacks. In the case where two Schools share the same building, each is self-contained and in terms of floor space unified. The separate building developments at University of Wisconsin - Green Bay closely resemble the Schools at Griffith University (even in scale). Here the similarity ceases as each of these buildings is arranged more in terms of the concentration of teaching services it provides than with the students of a particular College. Students undertake their studies in whichever building provides the particular service. There is less emphasis on students regarding a particular building as home. Staff, although housed in offices which provide a locational inter-disciplinary mix, are not necessarily accommodated so that they focus on the inter-disciplinary mix of the particular College.

Perhaps the relationship between a particular College theme and its identifiable home would have been more clearly established if the residential accommodation, which was to have provided separate facilities for each of the Colleges, had been built. Although, from a Griffith University point of view, one could argue that this establishes unnecessary boundaries and that residential accommodation on campus should be available to all. The total lack of on-campus residential accommodation at both Universities is a most noticeable gap. Both would benefit greatly from a range of on-site accommodation.

There were two specific facilities at the University of Wisconsin - Green Bay, of significant benefit to the University and certainly of benefit to the University in its relationships with the community. These were an excellent building for the Visual and Performing Arts and a competition-standard Indoors Sports Building. Both facilities were well-utilised.

All major buildings at the University of Wisconsin - Green Bay are linked by an underground pedestrian street which is well-conceived and has all manner of interesting shop-fronts, conversation areas and information services built into it. Functionally, because of winter conditions with sub-zero temperatures and snow, it is a great asset; however, habit patterns are now so strongly developed that this is the preferred route all year round. The lack of above ground people moving from building to building is most noticeable and I wonder what the impact of this apparent emptiness might have on the general community in its perceptions of the university.

University of California - Santa Cruz.

The University of California at Santa Cruz has been developed to offer a collegiate-style of education. The planning base was for 27 500 students as an ultimate population to be reached in 1990. Detailed plans were for 15 to 20 residential colleges and ten professional schools, focusing on a core of joint university facilities which included academic and science centres. These centres were to provide intra-

college contact and instruction, and research spaces. Student numbers in the colleges would vary from 250 to 1000. A residential college was an academic unit providing not less than half a student's instruction. It was to be his centre of academic life and the place where he lived, dined, and led most of his social life. Academic emphasis in the colleges would vary although all would provide undergraduate liberal arts education. Courses would be kept small with emphasis on seminars and tutorials. There would be an interplay and exchange among colleges with specialised courses in one college open to qualified students from other colleges.

The University was developed on a quite magnificent 2 000 acre-site in the foothills above the Pacific Ocean. Physical development has been very much in sympathy with the site. Current student enrolment is 6 000, well behind the initial planning expectations, again reflecting the severe cutbacks in educational funding and declining student enrolments. At the time of my visit a full planning review was nearing completion, which was looking at a plan for greatly reduced ultimate student numbers and ways of coping with the problem of physical developments which had proceeded with the anticipation of continuing and rapid growth. The main problems, as I saw them, were the physical distances between the various elements of the University, the thinness of the student population when spread amongst them and the slow individual college growth rates. There were approximately 3 000 student residential places on the campus which the University was finding hard to fill. Students were preferring to live in or near Santa Cruz and commute the three miles to the campus. I felt that this slowed rate of growth and the relative isolation of the campus from town and the distances between colleges within the campus were significant contributors.

University of California - Irvine.

The University of California at Irvine was the largest of the inter-disciplinary focused universities on my itinerary. Open for teaching in 1965 the University had an ultimate enrolment projected to 27 500. At the time of my visit student enrolment was 11 700 with a reduced ultimate growth projection to 15 000

As part of its educational philosophy the University seeks to maintain an academic environment conducive to inter-disciplinary instruction and research, to emphasise programs of independent student research at all levels, to utilise a combination of research and instructional functions which elsewhere have been arranged solely for research, and to ensure that the students become familiar with both the depth of their major study and the breadth of related areas.

The University is currently developed around eight Schools:

1. The School of Biological Sciences, where the students work, is centred around a core program which covers the traditional subjects of biology arranged according to basic principles.

2. The School of Fine Arts, which emphasises a balance between professional competence and a liberal education.

3. The School of Humanities, containing the departments of Classics, English, and Comparative Literature, French and Italian, German and Russian, Spanish and Portugese, History and Philosophy.

4. The School of Physical Sciences, which offers pre-professional training and general education in the departments of Chemistry, Mathematics, and Physics.

5. The School of Social Sciences, which provides programs in Anthropology, Economics, Geography, Political Science, Psychology, and Sociology with an emphasis on the inter-dependent nature of these separate disciplines.

6. The School of Engineering, which furnishes training in the fundamentals underlying engineering and emphasises Systems Management, Electrical and Environmental Engineering.

7. The School of Medicine, the initial increment of a Health Services Complex.

8. The Graduate School of Administration, includes instruction and research traditionally offered in such separate departments as business administration, education and public administration.

Physically each of the five major academic disciplines: Humanities, Fine Arts, Social Science, Biological Sciences, Physical Sciences, and Engineering is identified in a distinct and separate quadrangle to provide the physical characteristics of separate recognisable elements. A sixth non-academic quadrangle forms a strong visual and functional tie to the Town Centre.

The six quadrangles are the elements of the central campus and are arranged radially. The University sees the benefits of the radial design in the shortening of distances between the quadrangles, the orderly incremental growth outwards from the initial core and clear identification of the separate academic functions.

My interest in the Irvine campus was based on a number of considerations. The physical planning for Irvine was evolved from a philosophy of inter-disciplinary education which is also similar to that of Griffith University. At Irvine, however, initial decisions appear to have been made concerning the educational philosophy that each of these schools would pursue and the number of schools around which the University would develop. This then allowed the quite structured radial with a "quadrangle" physical plan to be developed. At Griffith University the initial planning was perhaps more open-ended with the educational philosophy of four inter-disciplinary schools being clearly expressed and the possible direction for future schools being outlined. This to my mind required a looser approach to physical planning and the linear arrangement of schools along a pedestrian spine was appropriate. It allowed the individual schools to grow at varying rates and level off in terms of varying student numbers. In observing these differences I am not suggesting that either approach was "more successful"; in fact, it seemed that both approaches to physical interpretation may have been appropriate to the time and place.

ASPECTS OF STUDENT HOUSING

The majority of student housing at American universities is still provided in traditional on-campus residential halls. The quantity of university-owned accommodation is proportionately higher than in Australia. A number of universities provide accommodation for between 15 to 20 per cent of their student populations.

The systems developed to operate the accommodation are, in some instances, on a university-wide basis, using very sophisticated methods. The University of California at Santa Barbara operates a computerised system over its halls of residence which co-ordinates all management aspects including catering, cleaning, financial, and maintenance aspects.

In American universities it is common to find accommodation arranged on a two per room basis. This seems to have been historically accepted in America; few students I spoke to had any criticisms of this form of accommodation. It is most uncommon in Australian universities.

Housing co-operatives were an interesting aspect of student accommodation; at UCLA, University of California at Berkeley, and University of California at Santa Cruz there are non-profit housing co-operatives which have been operating successfully for many years. The co-op at Berkeley has been in operation for more than 40 years and provides accommodation for some 1 200 members in areas adjacent to the campus. The residents are expected to take an active part in all facets of operating and maintaining the houses, from government and management to dishwashing and gardening. Every resident contributes five hours of work per week to the co-operative. At the University of California at Irvine an experimental project in low-cost housing was nearing completion. A site on the campus was being prepared to accommodate 100 modular homes or trailer homes. Privately-owned trailer homes would be brought to the site where all other facilities would be provided at low rental. This scheme was implemented after the popular success of an earlier pilot scheme.

ACKNOWLEDGEMENTS

While this report has concentrated on the purpose of my study program I would be remiss if I did not acknowledge the magnificent hospitality extended to me throughout my whole tour. I have established friendships which I am sure will continue to be an enriching and valuable dimension of my tour. I must also thank the representatives of various organisations who act as hosts for international visitors and who so ably allowed me to experience the social and cultural aspects of towns and cities throughout the USA.

I must record my thanks to the people at all the institutions who arranged my itinerary with such care and thoroughness. I am grateful to the many people who so freely allocated their time for discussions with me. I was particularly impressed with the high standard of professionalism of the people I met, and their preparedness to be so frank in discussions made "doing business" a pleasure.

The Council for International Exchange of Scholars contributed greatly to the smooth running and success of my tour, from the time of my first correspondence from Australia to my final departure from the USA. In particular, I record my thanks to Jennifer Keefe and Susan Zelle.

I am particularly grateful to both the Australian-American Educational Foundation and my Vice-Chancellor at Griffith University, Professor F.J. Willett, for my being nominated and accepted for this study grant and their subsequent understanding in allowing the grant to be deferred because of family illness.

My final acknowledgements are to my colleagues at Griffith University for undertaking additional duties, and to my wife and family for their understanding and support during my absence.

INSTITUTIONS VISITED

Prior to arrival in the United States my University generously allowed me to undertake a study program covering 20 universities in Italy, Germany, France, and the United Kingdom over a period of eight weeks. In addition to the information obtained from these visits I believe the experience was of considerable benefit to my tour of the USA in that I was able to focus more precisely on the many matters I wished to explore.

On arrival in the USA in April, 1978, I spent 16 weeks visiting various institutions. Two extended periods, gaining operational level experience, were spent at the University of Wisconsin, Green Bay (four weeks) and the National Center for Higher Education Management Systems at Wiche, Boulder, Colorado (three weeks). In sequence I visited the following institutions and organisations:

3 April, 1978	Council for International Exchange of Scholars Washington, D.C.
4 April, 1978	Howard University Washington, D.C.
	American Institute of Architects Washington, D.C.
4 & 5 April, 1978	Georgetown University Washington, D.C.
5 April, 1978	National Park Service Washington, D.C.
6 April, 1978	Gallaudet College Washington, D.C.
	Office of Education Washington, D.C.
	APPA - Association of Physical Plant Operators of Universities and Colleges Washington, D.C.

7 April, 1978	CASE - Council for Advancement & Support of Education Washington, D.C.
	NACUBO - National Association of College & University Business Offices Washington, D.C.
	ERIC - Educational Resources Information Centre Clearing-house Washington, D.C.
	ACE - American Council on Education Washington, D.C.
10 April, 1978	City University of New York New York, New York
11 April, 1978	EFL - Educational Facilities Laboratories New York, New York
	Columbia University New York, New York
12 April, 1978	State University of New York at Stonybrook Stonybrook, New York
14 April, 1978	Yale University Connecticut
17 April, 1978	Radcliffe College Massachusetts
18 April, 1978	Harvard University Massachusetts
19 April, 1978	Massachusetts Institute of Technology Massachusetts
21-24 April, 1978	State University of New York at Buffalo - Amherst New York
24 April - 19 May, 1978	University of Wisconsin - Green Bay Wisconsin
25 & 26 May, 1978	University of Oklahoma Oklahoma
29 & 30 May, 1978	Oklahoma State University Oklahoma
31 May - 21 June, 1978	NCHEMS - National Centre for Higher Education Management Systems at - WICHE - Boulder Colorado
	University of Colorado Boulder, Colorado

31 May - 21 June, 1978	Colorado State University Fort Collins, Colorado
21-23 June, 1978	University of California at San Diego California
26 June, 1978	University of California at Irvine California
27 June, 1978	California State University at Fullerton California
27-30 June, 1978	University of California at Los Angeles California
30 June - 4 July, 1978	University of California at Santa Barbara California
7 July, 1978	Foothills College California
10 July, 1978	University of California Statewide System California
11 July, 1978	University of California at Berkeley California
12 July, 1978	University of California at Santa Cruz California
13 July, 1978	Stanford University California
17 July, 1978	Evergreen State College Washington
20 July, 1978	University of Hawaii at Manoa Hawaii